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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/789,851	02/26/2004	Aaron O. Vanderpool	ITL.1078US (P18386)	8453
21906	7590	08/16/2005	EXAMINER : SARKAR, ASOK K	
TROP PRUNER & HU, PC 8554 KATY FREEWAY SUITE 100 HOUSTON, TX 77024			ART UNIT 2891	PAPER NUMBER

DATE MAILED: 08/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/789,851	VANDERPOOL ET AL. 	
	Examiner	Art Unit	
	Asok K. Sarkar	2891	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 July 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) 14-17 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-13 and 18-21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>7/25/2005</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. Applicant's election of Group I claims 1 – 13 and 18 – 21 in the reply filed on July 25, 2005 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).
2. Claims 14 – 17 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected Group II claims, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in the reply filed on July 25, 2005.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claim 18 is rejected under 35 U.S.C. 102(b) as being anticipated by Yoshino, US 2001/0025994.

Yoshino teaches a method comprising performing an Arsenic Halo implant Before implanting to form P-type source/drain extensions in paragraphs 51 – 53.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 1 – 13 and 18 – 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chidambaram, US 2003/0207542 in view of Mansoori, US 6,830,980 and Park, US 6,303,450.

Regarding claims 1, 7 and 8, Chidambaram teaches a method of forming

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a source drain extension by implanting boron and fluorine in paragraphs 15, 45, and 51 – 55.

Chidambaram fails to teach implanting an additional species carbon to reduce transient enhanced diffusion of boron.

Mansoori teaches that carbon implantation in the source drain extension region can reduce the transient enhanced diffusion of dopants (such as boron) in column 5, lines 52 –63 for the benefit of providing substantial processing advantages during the device manufacturing in column 2, lines 28 – 53.

Park also teaches the beneficial effect of carbon in the source drain extension region to reduce the transient enhanced diffusion of boron in column 3, lines 15 – 38 for the benefit of producing a better CMOS device with reduced canyon and facet effects in column 2, lines 1 – 3.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Chidambaram and implant carbon in the source drain extension region to reduce transient enhanced diffusion of boron for the benefit of providing substantial processing advantages during the device manufacturing as taught by Mansoori in column 2, lines 28 – 53 and by Park in column 2, lines 1 – 3.

Regarding claims 3 and 10, Chidambaram fails to teach implanting fluorine to a depth deeper than the boron implant.

However, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Chidambaram and implant fluorine to a depth deeper than the boron implant because the purpose of fluorine implant is to

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reduce and/or prevent the diffusion of boron both vertically and laterally and therefore the layer of fluorine should reside below that of boron for the purpose of preventing boron diffusion.

Regarding claims 2 and 9, Chidambaram fails to teach implanting fluorine to a depth deeper than the boron implant.

Mansoori teaches that carbon implantation in the source drain extension region can reduce the transient enhanced diffusion of dopants in column 5, lines 52 –63 for the benefit of providing substantial processing advantages during the device manufacturing in column 2, lines 28 – 53.

Park also teaches the beneficial effect of carbon in the source drain extension region to reduce the transient enhanced diffusion of boron in column 3, lines 15 – 38 for the benefit of producing a better CMOS device with reduced canyon and facet effects in column 2, lines 1 – 3.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Chidambaram and implant carbon to a depth deeper than the boron implant because the purpose of carbon implant is to reduce and/or prevent the transient enhanced diffusion of dopants and therefore the layer of carbon very similar to that of fluorine should reside below that of boron for the purpose of preventing boron diffusion.

Regarding claims 4, 5, 11 and 12, Chidambaram (in view of Mansoori and Park) teaches the energy and dose of fluorine implant to be below 6 KeV and a dose of about 10^{15} atoms/cm² in paragraphs 52 and 53, but fails to teach the

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energy and dose of carbon implant although both Mansoori and Park teach carbon implant.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Chidambaram and implant carbon to a depth deeper than the boron implant because the purpose of carbon implant is to reduce and/or prevent the transient enhanced diffusion of dopants and therefore the layer of carbon very similar to that of fluorine should reside below that of boron for the purpose of preventing boron diffusion.

However, given the substantial teaching of Chidambaram in view of Mansoori and Park, it would have been obvious to one with ordinary skill in the art at the time of the invention to judiciously adjust and control the implantation energy and dosage parameters and use the energy to be below 6 KeV and a dose of about 10^{15} atoms/cm² during the LDD formation through routine experimentation and optimization to achieve optimum benefits (see MPEP 2144.05) and it would not yield any unexpected results.

Note that the specification contains no disclosure of either the critical nature of the claimed processes or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen methods or upon another variable recited in a claim, the Applicant must show that the chosen methods or variables are critical (*Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir., 1990)). See also *In re Aller, Lacey and Hall* (10 USPQ 233 – 237).

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9. Claims 6 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chidambaram, US 2003/0207542 in view of Mansoori, US 6,830,980 and Park, US 6,303,450 as applied to claims 1 and 7 above, and further in view of Yoshino, US 2001/0025994.

Chidambaram in view of Mansoori fails to teach the halo implant. Park teaches that carbon enhances the diffusion of arsenic for halo doping and teaches precautionary measure before carbon implantation in column 3, lines 20 – 38, but fails to teach performing halo implant before boron implant.

Yoshino teaches that that halo (pocket) implantation can be carried out before or after boron LDD implantation in paragraphs 51 – 53 and therefore they are functionally equivalent.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Chidambaram in view of Mansoori and Park to carry out halo (pocket) implantation before boron LDD implantation as taught by Yoshino in paragraphs 51 – 53 and appropriate precaution should be taken not to diffuse the As into the B dopant region by carrying out the implantation annealing for As before the B implantation and dopant annealing.

10. Claims 19 – 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yoshino, US 2001/0025994 in view of Chidambaram, US 2003/0207542; Mansoori, US 6,830,980 and Park, US 6,303,450.

Yoshino teaches boron implantation for the P – type source/drain extension, but fails to teach carbon and fluorine implants and their depth.

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Chidambaram, Mansoori and Park teach these limitations as were explained above in rejecting claims 1 – 3 and 7 – 10.

Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Asok K. Sarkar whose telephone number is 571 272 1970. The examiner can normally be reached on Monday - Friday (8 AM- 5 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, William B. Baumeister can be reached on 571 272 1722. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

12. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Asok K. Sarkar
August 12, 2005

Primary Examiner